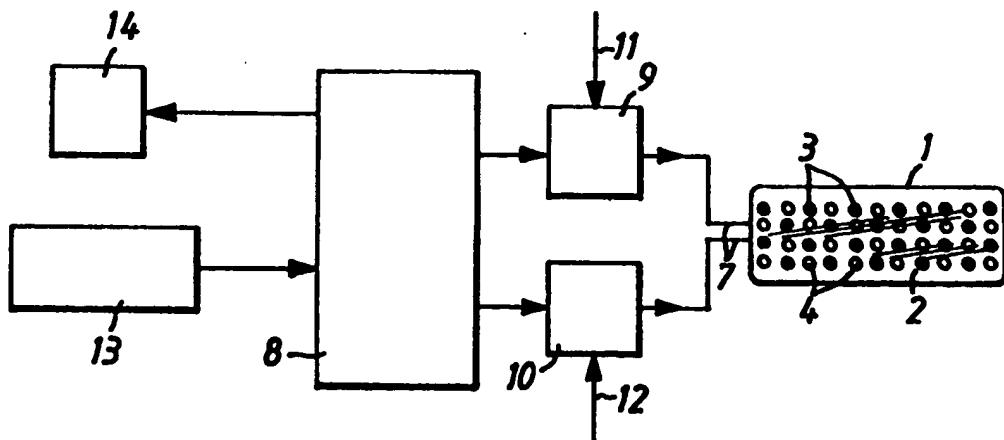




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(54) Title: DEVICE FOR WOUND HEALING BY MEANS OF LIGHT



## (57) Abstract

A device for healing wounds and sores with the aid of light, including a light emitting element which is intended to lie against or be held close to a wound or sore on the body of an individual, and drive means for driving the light emitting element, wherein the light emitting element includes light emitting diodes or like devices and is constructed to emit infrared light. The invention is characterized in that the drive means (8, 9, 19) is constructed to cause the light emitting element (1) to emit infrared light in a first stage for a first predetermined length of time and thereafter to emit visible red light in a second stage for a second predetermined length of time; in that the drive means (8, 9, 10) is constructed to cause the light emitting element (1) to pulsate the emitted infrared light and the emitted red light respectively in accordance with a predetermined series of pulse frequencies over said predetermined time periods.

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device for wound healing by means of light

The present invention relates to a device for healing wounds and sores with the aid of light, where, more specifically, 5 the light facilitates healing of the wound or sore and accelerates the healing process.

It has been found that the treatment of wounds and sores with the aid of light has a favorable effect on the healing 10 process, such as to accelerate healing. This applies to both wounds in the form of continuity interruptions in normal tissue and such sores as pressure sores caused by violence, leg ulcers, burn injuries, etc..

15 It has been observed that infrared light has a favorable effect on the healing of wounds and sores.

The present invention is based on the understanding that light treatment effected by transmitting given light at given 20 time intervals will give a significantly improved effect in the form of a shortened healing time. The present invention enables the time taken to heal a wound or sore to be halved in all essential in comparison with a healing process in which no treatment is given.

25 The present invention thus relates to a device for healing wounds and sores with the aid of light, this device including a light emitting element which is intended to lie against or be held close to a wound or sore on the body of an individual, and a means for powering the light emitting element, wherein the light emitting element includes light emitting diodes or the like and is intended to emit infrared light, said device being characterized in that the power means is constructed to cause the light emitting element to emit infrared light in a first stage for a first predetermined length of time, and thereafter to cause the light emitting element to emit visible red light in a second

stage for a second predetermined length of time; in that the power means is constructed to cause the light emitting element to pulsate the emitted infrared light and the red light respectively in accordance with a predetermined series 5 of pulse frequencies over said predetermined time periods.

The invention will now be described in more detail, partly with reference to an exemplifying embodiment of the invention illustrated in the accompanying drawing, in which 10 Figure 1 is a block schematic illustrating the device, and Figure 2 is a side view of a light emitting element.

Figures 1 and 2 illustrate a device for healing wounds and sores with the aid of light, said device including a light emitting element 1 which is intended to be placed against or held close to a wound or sore on the body of an individual. 15 The light emitting element is shown from one side in Figure 2 and from beneath in Figure 1. This member includes a housing 5 which is provided with a transparent plate 6. Beneath the plate 6 there is located a surface 2 in which a 20 number of light emitting diodes 3, 4 or corresponding devices are mounted. Thus, the light emitting diodes are intended to transmit light through the plate 6 when activated, i.e. when supplied with current through a cable 7. In use, the housing 25 5 is held so that the plate 6 will lie against the part of the body to be treated. The device also includes drive means 8, 9, 10 for driving the light emitting element 1. The light emitting element 1 includes light emitting diodes 3 or like devices which are constructed to emit infrared light. These 30 diodes are marked with solid circles in Figure 1.

According to the invention the drive means 8, 9, 10 are constructed to cause the light emitting element 1 to emit infrared light in a first stage for a first predetermined length of time, and then to emit visible red light in a second stage for a second predetermined length of time. 35 Visible red light is emitted by means of light emitting

diodes 4 or like devices. These devices are marked with hollow circles in Figure 1. It is extremely important that the treatment is carried out in the order infrared light followed by visible light.

5

According to the present invention, the drive means 8, 9, 10 are also constructed to cause the light emitting element 1 to pulsate the emitted infrared light and the red light respectively in accordance with a predetermined series of pulse frequencies over the aforesaid time periods.

10

The drive means include a computer 8 and associated memory, and drive circuits 9, 10 which are controlled by the computer. These drive circuits 9, 10 are supplied with voltage for 15 powering the light emitting diodes, through conductors 11, 12. One drive circuit, 9, is intended to activate the infrared light emitting diodes 3 and the other drive circuit 10, is intended to activate the light emitting diodes 4 that emit visible red light. The computer and the drive circuits 20 are of a suitable known kind.

20

The infrared light emitting diodes 3 are preferably GaAs-type semi-conductors (Galliumarsenide) which emit light having a wavelength of 950 nanometers. The light emitting diodes 4 which emit visible light are preferably of the GaAs-type 25 which emit light having a wavelength of 660 nanometers.

25

According to one preferred embodiment of the invention, the light emitting diodes are present in the light emitting element in such numbers that the infrared light emitting diodes together deliver a light power of 900 milliwatts, while the red light emitting diodes together have a power of 3000 millicandela.

30

35 Mention is made in the foregoing of predetermined lengths of times over which light is emitted at a treatment. According to one preferred embodiment, these predetermined

time periods are approximately of equal duration. Furthermore, the predetermined time period lies in a range of 2-4 minutes, preferably 3 minutes.

5      Mention is made in the aforesaid of a series of pulse frequencies. According to one preferred embodiment, each series is comprised of three mutually sequential pulse frequencies at which respective light is emitted.

10     In summary, this means that there is first emitted solely infrared light, said light being emitted so as to be pulsed in a manner such that there is first emitted light which is pulsed at a given pulse frequency, whereafter the light is emitted while pulsed at a second pulse frequency, and then 15     at a third pulse frequency. Thereafter there is emitted only visible red light, this light being pulsed at a first pulse frequency and then at a second pulse frequency and thereafter at a third pulse frequency.

20     Provided that the predetermined time period is three minutes, infrared light is emitted over a period of three minutes, and is then followed by visible red light over a period of three minutes. Preferably, the duration of each pulse frequency in the series is one minute.

25     According to a highly preferred embodiment of the invention, the first series of pulse frequencies is 78 +/- 10 Hz, 702 +/- 20 Hz and 8.58 KHz +/- 100 Hz. The infrared light is thus first pulsed at a pulse frequency of 78 Hz, followed by a 30     pulse frequency of 702 Hz and then at a pulse frequency of 8.58 KHz, whereafter visible red light is emitted in accordance with the same series.

35     A typical treatment of a wound or sore is effected by turning the light emitting element to face the wound or sore and infrared light is emitted in accordance with the aforesaid series for a total period of three minutes, whereafter

visible red light is also emitted in accordance with said series for a total period of three minutes. Treatment thus takes six minutes. The treatment is repeated from two to three times each week. Typically, the effect of the treatment  
5 will be seen after 4-6 treatments.

According to one preferred embodiment, the infrared light and the red light respectively are emitted in accordance with another pulse frequency series after from 4 to 6 treatments  
10 using the aforementioned series. According to this embodiment, the drive means 8, 9, 10 is intended to cause the light emitting element 1 to emit a second series of pulse frequencies, this second pulse frequency series being, 15.6 +/- 3 Hz, 287 +/- 20 Hz and 31.2 +/- 5 Hz. Each type of  
15 light is preferably emitted for a total period of three minutes also with this second pulse frequency series.

In the foregoing, pulse frequency series have been mentioned in which the pulse frequency is given a relatively narrow  
20 interval. It is namely important that the pulse frequency is the nominal frequency or very close thereto. However, the aforesaid predetermined time periods can be varied slightly.

Connected to the computer 8 is a keyboard 13 by means of  
25 which relevant series and the duration of said series can be chosen by depressing the appropriate keys. There will preferably be found a number of different preprogrammed treatment programs to choose from. To the computer 8 there is also connected a display 14 which presents desired data,  
30 such as the treatment program chosen, the time duration of the series, etc..

It will be understood that the construction of the light emitting element can be changed, and that the number and the power of the light emitting diodes can also be changed. The control circuit that includes the computer can also be modified.  
35

The present invention cannot therefore be considered restricted to the aforescribed embodiments, since the variations and modifications can be made within the scope of the following claims.

Claims

1. A device for healing wounds and sores with the aid of light, including a light emitting element which is intended to lie against or be held close to a wound or sore on the body of an individual, and drive means for driving the light emitting element, wherein the light emitting element includes light emitting diodes or like devices and is constructed to emit infrared light, characterized in that the drive means (8, 9, 19) is constructed to cause the light emitting element (1) to emit infrared light in a first stage for a first predetermined length of time and thereafter to emit visible red light in a second stage for a second predetermined length of time; in that the drive means (8, 9, 10) is constructed to cause the light emitting element (1) to pulsate the emitted infrared light and the emitted red light respectively in accordance with a predetermined series of pulse frequencies over said time periods.

20

2. An arrangement according to Claim 1 characterized in that the predetermined time periods are approximately of mutually equal duration; and in that the time period lies in a range of 2-4 minutes, preferably 3 minutes.

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3. An arrangement according to Claim 2, characterized in that each of said series is comprised of three mutually sequential pulse frequencies at which a respective light is emitted.

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4. An arrangement according to Claim 3, characterized in that a first series of pulse frequencies is 78 +/- 10 Hz, 702 +/- 20 Hz and 8.58 KHz +/- 100 Hz.

35

5. An arrangement according to Claim 4, characterized in that the drive arrangement (8,9,10) is constructed to cause the light emitting element (1) to emit a second series of pulse frequencies, this second pulse frequency series being

intended to be transmitted after a wound or sore has been treated with the first series from four to six times, this second series of pulse frequencies being 15.6 +/- 3 Hz, 287 +/- 20 Hz, and 31.2 +/- 5 Hz.

5

6. An arrangement according to any one of the preceding claims, characterized in that the light emitting element (1) includes infrared light emitting diodes (3) which emit light having a wavelength of 950 nanometers.

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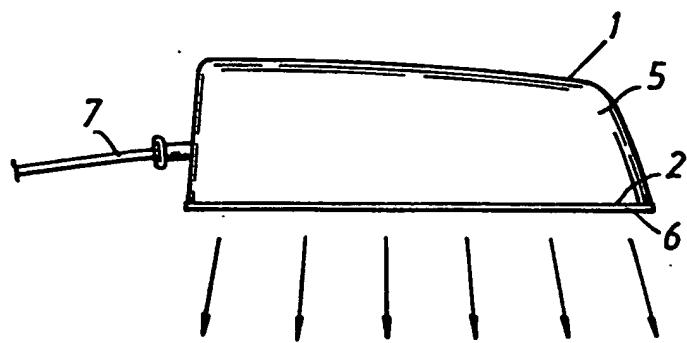
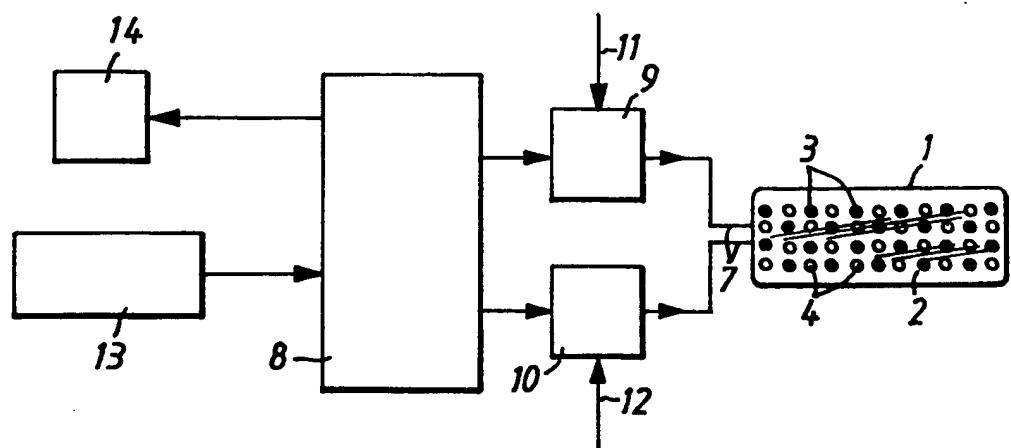
7. An arrangement according to any one of the preceding claims, characterized in that the light emitting element (1) includes red light emitting diodes (4) which emit light having a wavelength of 660 nanometers.

15

8. An arrangement according to Claim 6 or Claim 7, characterized in that the infrared light emitting diodes (3) together produce a light power of 900 milliwatts and the red light emitting diodes (4) together produce a power of 3000 20 millicandela.

25

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 95/00048

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61N 5/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## WPI, CLAIMS

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5259380 (EMANUEL MENDES ET AL), 9 November 1993 (09.11.93), column 3, line 9 - line 30; column 4, line 48 - column 5, line 31, figure 1, abstract  --	1,6-8
Y	US, A, 4930504 (COSTAS A. DIAMANTOPOULOS ET AL), 5 June 1990 (05.06.90), column 3, line 18 - line 50; column 11, line 46 - line 56; column 17, claim 34, abstract  --	1,6-8
A	WO, A1, 9309847 (LARSEN, ERIK), 27 May 1993 (27.05.93), abstract  --	1-8

 Further documents are listed in the continuation of Box C. See patent family annex.

- \* Special categories of cited documents
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Date of the actual completion of the international search

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**INTERNATIONAL SEARCH REPORT**

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**C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>Uppfinnaren &amp; konstruktionen, Volume, No 2, 1993, P-A Bengtsson, "Uppfinningen som botar sjukdomar med vanligt ljus", see whole document</p> <p>---</p> <p>-----</p>	1-8

INTERNATIONAL SEARCH REPORT  
Information on patent family members

25/02/95

International application No.  
PCT/SE 95/00048

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A- 5259380	09/11/93	NONE		
US-A- 4930504	05/06/90	CA-A-	1329416	10/05/94
		DE-A-	3882933	09/09/93
		EP-A,B-	0320080	14/06/89
		JP-A-	1136668	29/05/89
WO-A1- 9309847	27/05/93	AU-A-	2929492	15/06/93
		EP-A-	0568666	10/11/93